

**BIFENTHRIN/ACETAMIPRID COMPOSITIONS FOR CONTROL OF
GENERAL HOUSEHOLD PESTS**

5 This application claims the benefit of U.S. Provisional Application No. 60/535,373, filed January 9, 2004.

FIELD OF THE INVENTION

10 The present invention relates generally to insecticidal compositions. In particular, it pertains to compositions of insecticides useful for control of general household pests.

BACKGROUND OF THE INVENTION

15 General household pests are insects that have the potential to cause nuisance or harm to person and property, such as the German cockroach, American cockroach, Smokey-Brown cockroach, Oriental cockroach, house fly, biting fly, filth fly, red imported fire ant (RIFA), odorous house ant, carpenter ant, pharaoh ant, Argentine ant, mosquito, tick, flea, sowbug, pillbug, centipede, spider, silverfish, scorpion and bed bug. The following are some examples of nuisance or harm to
20 persons and property. Cockroaches and flies can appear in people's living environment at any place and at any time. They generally contaminate food and articles subjecting people to threats of bacteria and viruses. The continued proliferation of colonies of red imported fire ants, *Solenopsis invicta*, are becoming a serious problem in the United States. Fire ants are attracted to electrical circuits and
25 can cause failures in transformers, cables, connectors and related electrical hardware. Fire ants also can sting persons or animals and generally cause a localized allergic reaction on the area of the skin punctured by their stinging. Some individuals suffer a severe allergic reaction that can lead to anaphylactic shock, which can be fatal if not treated promptly. Many of the general household pests are
30 potentially dangerous since their bites or stings can similarly lead to allergic reaction.

 Insecticidal compositions have commonly been used to control general household pests. Of primary concern in developing an insecticidal composition to

control general household pests is the insecticide's 'knockdown' and 'mortality' characteristics. Knockdown refers to quick, short-term immobilization or death of the pest. Pests can recover from knockdown immobilization. Knockdown usually occurs within 10-30 minutes, but the timing is pest dependant. For example, 5 knockdown for house flies can occur at up to 2 hours because of their tolerance for insecticides and recovery abilities. Mortality refers to death of the pest. An optimal insecticide composition would have knockdown and mortality rates at or near 100% for all general household pests. Current insecticidal compositions, for example, have red imported fire ant and German cockroach mortality rates approaching 100%, 10 but their knockdown rates are only 80% or less for red imported fire ants and 40% or less for German cockroaches. Improved knockdown and mortality rates are desirable to ensure effective protection of persons and property from general household pests.

15

SUMMARY OF THE INVENTION

In accordance with the present invention, it has now been found that a new insecticidal composition significantly improves knockdown and mortality rates to general household pests. Specifically, an insecticidal composition containing a mixture of bifenthrin and acetamiprid, results in a continuous chemical barrier that 20 provides both high knockdown and mortality rates to general household pests. Other aspects of the present invention will also be apparent.

DETAILED DESCRIPTION OF THE INVENTION

It has now been unexpectedly found that an insecticidal composition 25 containing bifenthrin and acetamiprid, results in high knockdown and mortality rates when applied to general household pests. A preferred liquid insecticide composition of the present invention is comprised of from 0.001% by weight to 0.12% by weight of bifenthrin and from 0.001% by weight to 0.20% by weight of acetamiprid.

Another embodiment of the present invention is a method for controlling general household pests comprising applying an insecticidally effective amount of a composition comprised of bifenthrin and acetamiprid to a locus where general household pest control is needed or expected to be needed. Preferred general

household pests are selected from German cockroach, American cockroach, Smokey-Brown cockroach, Oriental cockroach, house fly, biting fly, filth fly, red imported fire ant (RIFA), odorous house ant, carpenter ant, pharaoh ant, Argentine ant, mosquito, tick, flea, sowbug, pillbug, centipede, spider, silverfish, scorpion and bed bug. Preferred locus or loci are selected from a general household pest-infested structure, a structure that is expected to be general household pest-infested, or a location adjacent to the structures.

The amount of each insecticide in the composition can be varied over a wide range depending upon the target pest and the level of control desired. For controlling German cockroaches, a preferred liquid insecticide composition of the present invention is comprised of 0.001% by weight to 0.06% by weight of bifenthrin and 5 0.005% by weight to 0.10% by weight of acetamiprid. For controlling Red Imported Fire Ants, a preferred liquid insecticide composition of the present invention is comprised of 0.0575% by weight to 0.0625% by weight of bifenthrin and 0.025% by weight to 0.05% by weight of acetamiprid. For controlling house flies, a preferred liquid insecticide composition of the present invention is comprised of 0.001% by 10 weight to 0.005% by weight of bifenthrin and 0.01% by weight to 0.02% by weight of acetamiprid. For controlling bed bugs, a preferred liquid insecticide composition of the present invention is comprised of 0.0575% by weight to 0.0625% by weight of bifenthrin and 0.025% by weight to 0.05% by weight of acetamiprid.

A liquid insecticide is any formulation containing an insecticide where the 15 formulation is dispensed in an aqueous medium prior to its application to a locus where general household pest control is needed. That is to say, a liquid insecticide is made up of 1) an insecticide, 2) an aqueous medium and 3) other additives conventionally employed in insecticidal formulations (e.g. surfactants, wetting agents, freeze/thaw agents). All formulations of insecticides that are or can be 20 dispensed in an aqueous medium prior to application are, therefore, within the scope of the present invention (e.g. Micro-emulsions, Suspension concentrates, Emulsifiable concentrates, Wettable powders, Water dispersible granules, Capsule suspensions, Emulsifiable granules or combinations thereof).

The compositions of the present invention may be derived from 25 commercially available formulations of insecticides. For example, bifenthrin, sold

by FMC Corporation under the names and trademarks of TALSTAR® GC FLOWABLE INSECTICIDE/MITICIDE, or TALSTARONE® MULTI-INSECTICIDE, to name a few, find utility in the present invention. Formulations of acetamiprid that are particularly useful in the context of the present invention include, without limitation, acetamiprid (sold under the name and trademark of INTRUDER), sold as a 70% wettable powder. Using methods known to one skilled in the art, the above-mentioned formulations of insecticides can be dispersed in an aqueous medium to provide a composition containing an insecticidally effective amount of the insecticide.

The following examples further illustrate the present invention, but, of course, should not be construed as in any way limiting its scope. The examples set forth certain biological data illustrating the efficacy of the compositions of the present invention in controlling general household pests. Each example embodies a separate test wherein the pests were randomly selected from a population at a random age. Unless otherwise indicated, all parts, percentages, and the like are by weight. The spray chambers used in the examples were approximately 73-76 inches tall, 73-83 inches long and 31-33 inches deep with an adjustable shelf (approximately 22 inches deep) and a movable spray nozzle. The spray chambers were calibrated to deliver a volume of approximately 1 gallon of liquid per 1000 square feet of area at about 14-40 pounds per square inch of pressure. A DeVilbiss hand held sprayer (Atomizer model 152) manufactured by DeVilbiss located in Glendale Heights, Illinois was used in the testing with house flies. The DeVilbiss was used to apply approximately 3-5 milliliters of product at about 10 pounds per square inch.

25

EXAMPLE 1

Test to Determine German Cockroach Knockdown and Mortality Rates by Applications of Combinations of Bifenthrin and Acetamiprid

The compositions of the present invention were tested for German cockroach activity in the following manner:

Test compositions made up of TALSTARONE® MULT-INSECTICIDE and a 70% wettable powder of acetamiprid in distilled water were prepared that provided

appropriate rates of application of combinations of bifenthrin and acetamiprid, as well as bifenthrin and acetamiprid alone.

The spray chamber was then calibrated to deliver the treatment solution at the desired volume and pressure over the desired area on the chamber shelf. Spray chamber shelf height was adjusted to approximately 18 inches from the spray tip. The shelf was then covered with aluminum foil and the center of the shelf from front-to-back and end-to-end was determined. A desired number of 4.0" sieve circles were marked on the aluminum foil with a permanent marker. The inside of a desired number of PVC rings were coated with a petroleum jelly / mineral oil mixture (1:2 ratio). The PVC rings were placed on the sieve circles. 10 male German cockroaches were placed inside each PVC ring. The sprayer was activated and the test compound was applied to each PVC ring interior. German cockroach knockdown and mortality were measured. The following results were recorded:

Table 1
Knockdown and Mortality of German Cockroach by Application of Combinations of Bifenthrin and Acetamiprid

Treatment	Rate of Appln. (PPM)	Rate of Appln. (% by weight)	Knock-down Rate @ 10 minutes (%)	Knock-down Rate @ 15 minutes (%)	Knock-down Rate @ 30 minutes (%)	Mortality Rate @ 60 minutes (%)	Mortality Rate @ 120 minutes (%)	Mortality Rate @ 240 minutes (%)
A	10	0.001	0	3	23	40	-	50
	50	0.005	0	0	0	38	-	60
	200	0.02	0	3	45	100	100	100
	600	0.06	0	8	60	100	100	100
B	50	0.005	0	13	38	53	-	63
	100	0.01	0	8	38	58	-	63
	250	0.025	10	35	75	88	90	83
	500	0.05	8	45	88	80	98	80
B	1000	0.10	38	75	93	100	98	80
A + B	10/50	0.001 / 0.005	5	5	35	90	-	93
	10/100	0.001 / 0.01	0	0	13	90	-	100
	50/50	0.005 / 0.005	0	3	43	93	-	100
	50/100	0.005 / 0.01	15	23	60	95	-	100
	200/250	0.02 / 0.025	5	38	68	100	100	100
	200/500	0.02 / 0.05	48	60	98	100	100	100
	200/1000	0.02 / 0.10	58	90	100	100	100	100
	600/250	0.06 /	30	53	88	100	100	100

Treatment	Rate of Appln. (PPM)	Rate of Appln. (% by weight)	Knock-down Rate @ 10 minutes (%)	Knock-down Rate @ 15 minutes (%)	Knock-down Rate @ 30 minutes (%)	Mortality Rate @ 60 minutes (%)	Mortality Rate @ 120 minutes (%)	Mortality Rate @ 240 minutes (%)
		0.025						
	600/500	0.06 / 0.05	35	63	95	100	100	100
	600 / 1000	0.06 / 0.10	63	85	98	100	100	100
Untreated	0	0	0	0	0	0	0	0

A is bifenthrin, B is acetamiprid

EXAMPLE 2

5 Test to Determine Red Imported Fire Ant Knockdown and Mortality Rates by Applications of Combinations of Bifenthrin and Acetamiprid

The compositions of the present invention were tested for red imported fire ant activity in the following manner:

10 Test compositions made up of TALSTARONE® MULTI-INSECTICIDE and a 70% wettable powder of acetamiprid in distilled water were prepared that provided appropriate rates of application of combinations of bifenthrin and acetamiprid, as well as bifenthrin and acetamiprid alone.

15 The spray chamber was then calibrated to deliver the treatment solution at the desired volume and pressure over the desired area on the chamber shelf. Spray chamber shelf height was adjusted to approximately 18 inches from the spray tip. The shelf was then covered with aluminum foil and the center of the shelf from front-to-back and end-to-end was determined. The red imported fire ants to be treated were collected and placed in screened 16 oz paper cups. The paper cups
20 were placed onto the aluminum foil on the spray chamber shelf. The sprayer was activated and the test compound was applied to each paper cup interior. Red imported fire ant knockdown and mortality were measured. The following results were recorded:

25

Table 2
Knockdown and Mortality of Red Imported Fire Ant by Application of
Combinations of Bifenthrin and Acetamiprid

Treatment	Rate of Appln. (PPM)	Rate of Appln. (% by weight)	Knock-down Rate @ 10 minutes (%)	Knock-down Rate @ 15 minutes (%)	Knock-down Rate @ 30 minutes (%)	Mortality Rate @ 60 minutes (%)	Mortality Rate @ 120 minutes (%)	Mortality Rate @ 240 minutes (%)
A	300	0.03	63	100	100	100	100	100
	600	0.06	78	100	100	100	100	100
B	125	0.0125	0	0	10	5	65	90
	250	0.025	10	3	5	13	98	100
A + B	500	0.05	0	15	15	60	100	100
	300/125	0.03 / 0.0125	18	78	98	100	100	100
	300/250	0.03 / 0.025	5	98	95	100	100	100
	300/500	0.03 / 0.05	33	95	93	100	100	100
	600/125	0.06 / 0.0125	45	78	100	100	100	100
	600/250	0.06 / 0.025	65	93	100	100	100	100
	600/500	0.06 / 0.05	100	100	100	100	100	100
	Untreated	0	0	0	0	0	0	0

A is bifenthrin, B is acetamiprid

EXAMPLE 3

5 Test to Determine House Fly Knockdown and Mortality Rates by Applications of Combinations of Bifenthrin and Acetamiprid

The compositions of the present invention were tested for house fly activity in the following manner:

10 Test compositions made up of TALSTARONE® MULTI-INSECTICIDE and a 70% wettable powder of acetamiprid in distilled water were prepared that provided appropriate rates of application of combinations of bifenthrin and acetamiprid, as well as bifenthrin and acetamiprid alone.

15 A DeVilbiss hand held sprayer was used to deliver the treatment solution at the desired volume and pressure. The house flies to be treated were collected and placed in screened 16 oz paper cups. The hand held sprayer was activated and the test compound was applied to each paper cup interior. House fly knockdown and mortality were measured. The following results were recorded:

Table 3

Knockdown and Mortality of House Flies by Application of Combinations of Bifenthrin and Acetamiprid

Treatment	Rate of Appln. (PPM)	Rate of Appln. (% by weight)	Knock-down Rate @ 15 minutes (%)	Knock-down Rate @ 30 minutes (%)	Knock-down Rate @ 60 minutes (%)	Knock-down Rate @ 120 minutes (%)	Knock-down Rate @ 240 minutes (%)	Mortality Rate @ 1 day (%)
A	10	0.001	0	0	19	19	48	3
	50	0.005	0	19	59	63	100	63
B	100	0.01	47	47	53	41	53	16
	200	0.02	69	86	72	72	78	28
A + B	10/100	0.001/0.01	67	97	100	97	100	80
	10/200	0.001/0.02	66	91	97	100	100	75
	50/100	0.005/0.01	26	74	100	100	100	97
	50/200	0.005/0.02	66	100	100	100	100	100
Untreated	0	0	0	0	0	0	0	0

A is bifenthrin, B is acetamiprid

5

EXAMPLE 4

Test to Determine Bed Bug Mortality Rates by Applications of Combinations of Bifenthrin and Acetamiprid

10 The compositions of the present invention were tested for bed bug activity in the following manner:

 Test compositions made up of TALSTARONE® MULTI-INSECTICIDE and a 70% wettable powder of acetamiprid in distilled water were prepared that provided appropriate rates of application of combinations of bifenthrin and acetamiprid, as
15 well as bifenthrin and acetamiprid alone.

 The spray chamber was then calibrated to deliver the treatment solution at the desired volume and pressure over the desired area on the chamber shelf. Spray chamber shelf height was adjusted to approximately 10.5 inches from the spray tip. The shelf was then covered with aluminum foil and the center of the shelf from
20 front-to-back and end-to-end was determined. The bed bugs to be treated were collected and placed in screened 16 oz paper cups. The paper cups were placed onto the aluminum foil on the spray chamber shelf. The sprayer was activated and the

test compound was applied to each paper cup interior. Bed bug mortality was measured. The following results were recorded:

Table 4
Mortality of Bed Bugs by Application of Combinations of Bifenthrin and Acetamiprid

Treatment	Rate of Appln. (PPM)	Rate of Appln. (% by weight)	Mortality Rate @ 2 hours (%)	Mortality Rate @ 1 day (%)
A	200	0.02	85	100
	600	0.06	75	100
B	250	0.025	30	95
	500	0.05	60	100
	1000	0.10	95	100
A + B	200/250	0.02/0.025	90	100
	200/500	0.02/0.05	95	100
	200/1000	0.02/0.10	100	100
	600/250	0.06/0.025	90	100
	600/500	0.06/0.05	100	100
	600/1000	0.06/0.10	100	100
Untreated	0	0	5	65

A is bifenthrin, B is acetamiprid

10

In the context of the present invention, the term "insecticide" refers to the active chemical compound or ingredient, bifenthrin and acetamiprid, which kills or causes knockdown of insects. The term "bifenthrin" means 2-methylbiphenyl-3-ylmethyl (Z)-(1RS)-cis-3-(2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopropanecarboxylate or 2-methylbiphenyl-3-ylmethyl (Z)-(1RS, 3RS)-3-(2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopropanecarboxylate, CAS Registry Number 82657-04-3. The term "acetamiprid" means (E)-N¹-[(6-chloro-3-pyridyl)methyl]-N²-cyano-N¹-methylacetamidine, CAS Registry Number 135410-20-7. The term "liquid insecticide" refers to a formulation of an insecticide where the formulation can be dispensed in an aqueous medium prior to its application to a locus where insect control is desired. The term "locus" refers to any locations where control of insects is needed or expected to be needed. The term "general household pest" refers to any insect or pest, such as German cockroach, American cockroach,

Smokey-Brown cockroach, Oriental cockroach, house fly, biting fly, filth fly, red imported fire ant (RIFA), odorous house ant, carpenter ant, pharaoh ant, Argentine ant, mosquito, tick, flea, sowbug, pillbug, centipede, spider, silverfish, scorpion and bed bug, that cause harm or nuisance to person or property. The term "knockdown" refers to the quick, short-term immobilization or death of the insects. The term "mortality" refers to the death of the insects. The term "% by weight" refers to the weight of the insecticide or specified component as a percent of the total weight of the composition (e.g. including the aqueous medium, other insecticides, surfactants, wetting agents, freeze/thaw agents and combinations thereof).

Those of ordinary skill in the art will appreciate that variations of the invention may be used and that it is intended that the invention may be practiced otherwise than as specifically described herein. Accordingly, this invention includes all modifications encompassed within the spirit and scope of the invention as defined by the following claims.

15